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Forest Insect and Disease Conditions in the Southwestern Region, 1997

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Table of Contents

Introduction **1**

Conditions in Brief **2**

Status of Insects **4**

Bark Beetles 4

Defoliators 5

Miscellaneous Insects 7

Status of Diseases **8**

Dwarf Mistletoes 8

True Mistletoes 8

Root Diseases 8

Stem Decays 8

Aspen Stem Cankers 9

Stem Rusts 9

Foliage Diseases 9

Abiotic Damage 10

Biological Evaluations and Technical Assistance **11**

Other Entomology and Pathology Activities In 1997 ..... **13**

Training 13

Mountain Pine Beetle Susceptibility/Risk Rating in Southwestern Ponderosa Pine 13

Site and Stand Factors Associated with the Occurrence of Roundheaded Pine Beetle Outbreaks in Ponderosa Pine 13

Pinyon Ips Tree and Stand Conditions Project 13

Evaluation of Pinyon Sawfly Populations in NE Arizona 13

White Pine Blister Rust Studies 13

Wood Import Risk Assessment and Mitigation Evaluation Team 14

Web Site 15

List of Tables

Table 1. Prominent 1997 Forest Insect and Disease Activity (acres) in Arizona and New Mexico 4

Introduction

High levels of insect and disease activity are often equated with an unhealthy forest. It cannot be overemphasized, however, that the most basic "forest health problem" in the Southwest involves **overstocking of small and mid-size trees.** This situation, which occurs over vast areas, can have numerous consequences. Perhaps the most direct consequence is poor growth. This hinders the production of large trees, whether for timber or for their increasing aesthetic value. Plant diversity—particularly grasses, forbs, and shrubs—is generally reduced in a crowded forest, which in turn affects wildlife. Runoff usually decreases as tree densities increase, affecting the condition of riparian areas as well as those who use the water. The risk of severe wildfire increases as forests thicken, a concern that will continue to magnify.

As entomologists and pathologists, we are especially interested in how forest conditions affect the incidence of insects and diseases. High stocking levels generally lead to high risk for bark beetle activity. While bark beetles have historically had less impact in the Southwest than in other parts of the West, the potential for severe outbreaks here is increasing. The extensive, chronic outbreak of western spruce budworm occurring in northern New Mexico may well be related to increases in the amount of white fir and Douglas-fir. The distribution of dwarf mistletoes may not be much different than it was a century ago, but the number of infected trees has probably increased considerably. Present forest conditions appear to be more favorable for build-up of dwarf mistletoes than past conditions.

Over time, insects and diseases have profound and complex effects on the condition or "health" of forests. This report summarizes the current known status of insects and diseases in the forests of Arizona and New Mexico. Much of the insect information is based on annual aerial detection surveys. Most of the disease information is based on ground observations and surveys. Information on State and private lands was provided by Bob Celaya, Arizona State Land Department, and Bob Cain, New Mexico State University Cooperative Extension Service.

The report also includes a list of evaluations and reports prepared by members of our staff in 1997 that deal with specific insect and disease situations and related management activities. The final section describes several special forest entomology and pathology projects and activities currently being conducted in the Region.

Conditions in Brief

For the second straight year, the total area affected by bark beetles in the Southwest increased considerably. Tree mortality occurred in 93,760 acres in 1997 compared to 53,610 acres in 1996. Ponderosa pine mortality was caused by the roundheaded pine beetle (18,435 acres), western pine beetle (12,225 acres), mountain pine beetle (10,080 acres), and ips engraver beetles (25,085 acres). Douglas-fir beetles affected 4,455 acres; spruce beetles, 1,650 acres; fir engravers and western balsam bark beetles, 4,410 acres. Pinyon ips caused mortality over approximately 17,420 acres. The increase in overall bark beetle activity in 1996 was likely related to the severe drought that occurred from mid-1995 through mid-1996; beetle populations continued to increase in many areas in 1997.

Insect defoliator activity also increased Region-wide in 1997, with a total of 252,400 acres affected compared with 176,415 acres the previous year. Western spruce budworm defoliation was detected on 198,165 acres in 1997, up from 126,985 acres in 1996. Aerial surveys detected 27,970 acres of spruce aphid defoliation and 25,465 acres of aspen defoliation in 1997.

Dwarf mistletoes continue to be the primary forest pathogens in the Southwest. The estimated annual volume loss from these parasites is approximately 25 million cubic feet. Their incidence changes little from year to year, but is thought to have increased over the past century.

Root diseases cause an estimated 5 million cubic feet of volume loss annually. Armillaria and annosus are the most common root diseases in most areas. Incidence is usually higher in mixed-conifer and spruce-fir forests than in ponderosa pine forests. Like other native diseases including mistletoes, root diseases have both beneficial and damaging effects.

The incidence of white pine blister rust continues to increase in the Sacramento and adjoining White Mountains of southern New Mexico.

Table 1. Prominent 1997 Forest Insect and Disease Activity (acres) in Arizona and New Mexico.

Agent	State	National Forests	State & Private	Other Federal	Total
Roundheaded Pine Beetle	AZ	5	**	6,650	6,655
	NM	6,575	**	5,210	11,785
Ips Beetle (ponderosa pine)	AZ	18,680	1,925	4,040	24,645
	NM	385	50	0	435
Douglas-fir Beetle	AZ	3,725	**	730	4,455
	NM	0	**	0	0
Mountain Pine Beetle	AZ	10	**	10,015	10,025
	NM	55	**	0	55
Spruce Beetle	AZ	415	**	0	415
	NM	1,190	**	45	1,235
Western Pine Beetle	AZ	7,650	**	3,760	11,410
	NM	820	**	0	820
True Fir Beetles	AZ	3,535	**	250	3,785
	NM	620	**	0	620
Pinyon Pine Needle Scale	AZ	++	**	++	++
	NM	6,600	++	0	6,600
Ponderosa Pine Needle Miner	AZ	0	**	0	0
	NM	0	19,400	++	19,400
Western Spruce Budworm	AZ	1,090	**	0	1,090
	NM	176,835	19,960	280	197,075
Spruce Aphid	AZ	11,805	**	16,165	27,950
	NM	++	**	**	++
Ponderosa Pine Needle Cast	AZ	10	**	90	100
	NM	2,475	++	0	2,475
Aspen Defoliation	AZ	2,245	20	485	2,750
	NM	18,775	3,540	400	22,715
Root Diseases	AZ	219,000	**	**	219,000
	NM	860,000	**	**	860,000
Dwarf Mistletoes	AZ	1,040,000	674,000	25,000	1,739,000
	NM	1,114,000	348,000	581,000	2,069,000

***** = No information available.***

****++ = Significant activity observed, but no acreage figures determined.***

Status of Insects

Bark Beetles

Douglas-fir Beetle

Dendroctonus pseudotsugae
Host: Douglas-fir

Tree mortality caused by this insect increased considerably in Arizona, with 4,460 acres affected in 1997 compared to 835 acres the previous year. Mortality occurred on the Apache-Sitgreaves (3,665 acres) and Coconino (60 acres) National Forests and on the Navajo (195 acres) and Fort Apache (535 acres) Indian Reservations. No significant activity was detected in New Mexico.

Ips Beetles

Ips spp.
Primary Hosts: Ponderosa pine, Pinyon pine

Ponderosa pine mortality caused by ips beetles occurred on approximately 25,085 acres in 1997, down somewhat from 1996 (30,230 acres). In Arizona, mortality was detected on the Coconino (11,800 acres), Coronado (80 acres), Kaibab (610 acres), Prescott (1,205 acres), and Tonto (4,990 acres) National Forests; Fort Apache (40 acres), San Carlos (3,530 acres), and Navajo (460 acres) Indian Reservations; Grand Canyon National Park (15 acres); and on about 1,920 acres of State and private lands. At several of these locations, beetle activity was associated with extensive snow breakage. In New Mexico, mortality was detected on the Carson (120 acres) and Lincoln (265 acres) National Forests and on about 50 acres of private land in and around the village of Ruidoso.

Pinyon pine mortality caused by pinyon ips, *Ips confusus*, was extensive in Arizona in 1997. The largest area covered 12,810 acres on the Coconino National Forest and adjacent State and private lands. Mortality rates approached 40 percent, with trees 1.7 inches in diameter (root collar) and greater killed. Elsewhere, a smaller outbreak affected 1,225 acres on the Kaibab National Forest and 3,355 acres on adjacent State and private lands. Only minor pinyon ips activity was detected in New Mexico.

Spruce ips were detected during ground surveys of areas heavily defoliated by western spruce budworm on private lands in northern Taos County, New Mexico.

Mountain Pine Beetle

Dendroctonus ponderosae
Primary Host: Ponderosa pine

Overall, tree mortality increased in 1997 with 10,080 acres affected compared to 3,295 acres in 1996. Most of the mortality (10,000 acres) occurred in Grand Canyon National Park. This activity occurred on the north side of the Park in a relatively inaccessible area. Other mortality was reported on the Kaibab National Forest (10 acres) and the Arizona Strip (BLM land, 15 acres) in Arizona, and on the Santa Fe National Forest (55 acres) in New Mexico.

Roundheaded Pine Beetle

Dendroctonus adjunctus
Primary Host: Ponderosa pine

Overall, tree mortality nearly doubled in 1997 with 18,435 acres affected compared to 9,340 acres in 1996. In Arizona, most of the activity occurred on the Fort Apache Indian Reservation (6,650 acres). Only about 3 acres of mortality were detected on the Coronado National Forest, indicating a continuing decline of the population in the Pinaleno Mountains. Considerable activity continued in the Sacramento Mountains of southern New Mexico, on both the Lincoln National Forest (6,575 acres) and the Mescalero Apache Indian Reservation (5,015 acres). The largest concentrations of mortality occurred south of Mayhill and from Timberon to Sunspot.

Spruce Beetle

Dendroctonus rufipennis
Host: Spruce

Tree mortality increased over two-fold, from 615 acres in 1996 to 1,650 acres in 1997. In Arizona, mortality was detected on the Kaibab National Forest (415 acres). In New Mexico, mortality was detected on the Carson (300 acres), Cibola (230 acres), Santa Fe (510 acres), and Lincoln (150 acres) National Forests, and on the Mescalero Apache Indian Reservation (45 acres).

Western Pine Beetle

Dendroctonus brevicomis
Primary Host: Ponderosa pine

Activity increased significantly for the second straight year, with 12,225 acres affected in 1997 compared

with 6,480 acres in 1996 and 1,910 acres in 1995. In Arizona, mortality occurred on the Apache-Sitgreaves (7,630 acres) and Coconino (15 acres) National Forests, and on the Navajo (1,945 acres) and Fort Apache (1,815 acres) Indian Reservations. In New Mexico, significant mortality was detected on the Cibola (35 acres) and Gila (785 acres) National Forests.

True Fir Beetles

Fir Engraver Beetle, *Scolytus ventralis*
Western balsam bark beetle, *Dryocoetes confusus*
Hosts: White and Subalpine/Corkbark fir

Tree mortality increased in 1997, occurring over 4,410 acres compared to 2,820 acres the previous year. In Arizona, activity was detected on the Apache-Sitgreaves (920 acres), Coconino (1,660 acres), Coronado (65 acres), and Kaibab (895 acres) National Forests, on the Fort Apache Indian Reservation (245 acres), and in Grand Canyon National Park (5 acres). In New Mexico, activity was found on the Cibola (45 acres), Santa Fe (75 acres), Gila (295 acres), and Lincoln (205 acres) National Forests.

Cypress beetles, *Phloesinus* spp., caused scattered mortality to Arizona cypress around Sedona, Arizona, and at Fort Bayard National Cemetery in New Mexico.

Red turpentine beetles, *Dendroctonus valens,* attacked several ponderosa pines last summer in a visually-sensitive thinning area near Los Alamos, New Mexico. High levels of turpentine beetle activity were associated with thinning and logging on private lands near Mt. Taylor and on the eastern foothills of the Sangre de Cristo Mountains in 1995 and 1996, but did not result in significant tree mortality.

Defoliators

Western Spruce Budworm

Choristoneura occidentalis
Host: True firs, Douglas-fir, Spruce

Regional defoliation increased in 1997, with a total of 198,165 acres detected compared to 126,985 acres the previous year. In Arizona, activity was again limited to the Kaibab National Forest (1,090 acres). In New Mexico, defoliation occurred on the Carson (156,325 acres), Santa Fe (20,230 acres), Gila (240 acres), and Lincoln (40 acres) National Forests; on the Santa Clara Indian Reservation (280 acres), and on about 19,960 acres of State and private lands in northern New Mexico.

Douglas-fir Tussock Moth

Orgyia pseudotsugata
Hosts: White fir, Douglas-fir, Spruce

No defoliation was detected in Arizona in 1997. Pheromone trap catch information from the Early Warning Detection Program suggests that populations are rising again in the Pinal and Sierra Ancha Mountains on the Tonto National Forest in Arizona, approaching levels observed in 1992, the last time visible defoliation was observed. Populations continue to decline on West Peak in the Pinaleno Mountains, Coronado National Forest, where visible defoliation was observed in 1995. Elsewhere in the state populations are at very low levels.

This insect continues to be an urban problem in northern New Mexico. In 1997 defoliation was again detected in the communities of White Rock, Los Alamos, Santa Fe, and Espanola. Occasional defoliation of landscape trees has also been found in Cedar Crest, Raton, Alto, Glorietta, Pecos and Ruidoso.

Aspen Defoliation

Western Tent Caterpillar, *Malacosoma californicum*
Large Aspen Tortrix, *Choristoneura conflictana*
Black Leaf Spot, *Marssonina populi*

These agents, alone or in combination, accounted for approximately 25,465 acres of defoliation in 1997, somewhat less than the previous year (35,650 acres). Defoliation was detected in Arizona on the Apache-Sitgreaves (820 acres), Coconino (305 acres), Coronado (50 acres), Kaibab (910 acres), and Tonto (160 acres) National Forests; on the Navajo (25 acres) and Fort Apache (460 acres) Indian Reservations; and on about 20 acres of private land. In New Mexico, it was found on the Carson (10,185 acres), Cibola (2,080 acres), Santa Fe (5,550 acres), and Lincoln (960 acres) National Forests; on the Mescalero Apache (280 acres) and Santa Clara (120 acres) Indian Reservations; and on about 3,540 acres of private lands in northern New Mexico.

Spruce Aphid

Elatobium abietinum

Host: Spruce

Spruce aphid defoliation detected by aerial survey increased from 10,780 acres in 1996 to 27,970 acres in 1997. This occurred on the Apache-Sitgreaves National Forests (11,805 acres) and the Fort Apache Indian Reservation (16,165 acres) in Arizona. Significant defoliation attributed to this insect was also seen from the ground on the Sacramento Ranger District of the Lincoln National Forest in New Mexico.

Pinyon Sawfly

Zadiprion rohweri

Pinyon defoliation was detected on 2,995 acres of the Navajo Indian Reservation in 1997, compared to 600 acres in 1996. The most heavily affected area is located on the south rim of Canyon De Chelly in northeast Arizona. Ground surveys conducted in July indicated that pinyon mortality rates within the outbreak area are low to date, approximately 3 percent; however, a majority of the pinyons in the area have very low live crown ratios (less than 30 percent) as a result of the outbreak so mortality rates could increase over time. Trees in all size classes have been affected. In New Mexico, minor defoliation was detected in Santa Fe, Sandoval, and San Miguel counties in 1997.

Pinyon Needle Scale

Matsucoccus acalyptus

In Arizona, scale continues to affect pinyon at several locations. Defoliation was observed in the Prescott area, as well as at Canyon De Chelly where it was associated with the pinyon sawfly. In New Mexico, some 6,600 acres were again affected in the Burro Mountains on the Silver City Ranger District, Gila National Forest. Chronic outbreaks (acres unknown) continue on Federal lands in the San Mateo, Datil and Capitan mountains. Other woodland damage has been observed on private lands south of Willard, east of El Rito, south of Corona, and east of Silver City. Damage to landscape trees was common statewide.

Ponderosa Pine Needle Miner

Coleotechnites ponderosae

In New Mexico, extensive areas of discoloration were observed from the ground on the Jicarilla Apache Indian Reservation in northern New Mexico. Significant activity was also found on stocking plots located on the Santa Clara Indian Reservation, where it had been noted in 1994. A large outbreak continued on State and private land in the eastern foothills of the Sangre de Cristo Mountains, with about 19,400 acres affected compared to 27,000 acres the previous year. Pockets of activity were also found on private lands south of Las Vegas in the Mineral Hill and San Geronimo areas. In Arizona, needle miner was found on ponderosa pines near Nutrioso, where it had been observed in 1990.

Bull pine sawfly, *Zadiprion townsendii,* was found on ponderosa pine at low levels in several chronically infested areas of Santa Fe. These insects are also common minor defoliators in Las Vegas, Cedar Crest, and Mountainair, New Mexico.

Fall webworm, *Hyphantria cunea*, defoliation continued to be common in landscape and lower elevation riparian hardwoods, especially elms and cottonwoods. The visual impacts of this insect have been a concern at the Nambe Falls Recreation Area in northern New Mexico.

Tiger moth, *Halisodota* spp., caterpillars were abundant on ornamental cypress and juniper in Albuquerque and caused problems to people allergic to their hairs. Their tents are also occasionally found on forest trees.

Linden looper, *Erannis tiliaria*, caused extensive (acres undetermined) early defoliation of oak and maples in the Fourth of July Canyon area of the Manzano Mountains. We are unaware of any previous reports of this insect in the Southwest.

Alder flea beetle, *Altica ambiens*, was prevalent in many locations in the Sedona-Beaver Creek area of Arizona. Heavy defoliation, nearly complete in some cases, was observed along Beaver Creek and Red Tank Draw in June. Defoliation was also observed in several locations along Oak Creek. Alders refoliated and looked much better later in the summer.

Miscellaneous Insects

Twig beetle, *Pityophthorus* spp., damage to ponderosa and pinyon pines dropped dramatically in 1997. Outbreaks which occurred in 1996 at numerous locations throughout the Southwest appear to have been drought related.

Pine tip moth, *Rhyaciona* spp., continued to damage landscape pines in Albuquerque and Santa Fe. The most severe injury appears to be from the Nantucket and western pine tip moths, although several other species are routinely caught in pheromone traps used to monitor these pests. Nantucket pine tip moth has continued to expand its range in Santa Fe.

Pinyon pine tip moth, *Dioryctria albovittella,* damage continued to decline in the Santa Fe area, the site of an outbreak in 1994. A new outbreak was reported on private lands east of Taos in 1997.

Conifer aphids, *Cinara* spp., were observed feeding on terminal and lateral shoots and trunks of ponderosa pine saplings in southwest Prescott in May. Needle discoloration was noted later in summer on pines in the area and was presumed to be caused by the aphids.

Oystershell scale, *Lepidosaphes ulmi*, continues to cause stunting, foliage discoloration, bark injury and some mortality to aspen in the Flagstaff area. Both ornamental and naturally growing aspens have been affected.

Prescott scale, *Matsucoccus vexillorum,* continues to cause branch dieback in several areas in Arizona including the Fort Apache Indian Reservation and the Coconino National Forest. Areas of heaviest impact occur along Highway 260 between McNary and the turnoff to Hawley Lake and along Highway 87 in the vicinity of Baker Butte.

Clearwing moths, *Sesia* spp., were identified causing extensive injuries to ornamental poplars and aspen in the Flagstaff area. Larval feeding was concentrated mainly in the lower trunk, root collar, and exposed roots.

Bagworms (family *Psychidae*) have become an increasing problem in the Albuquerque area on junipers, cypress, and a number of hardwoods, particularly sycamores.

Status of Diseases

Dwarf Mistletoes

Arceuthobium spp.

Hosts: most conifers, especially pines and Douglas-fir

Dwarf mistletoes are the most significant tree pathogens (disease-causing organisms) in forests of the Southwest. There are eight different species in the Region, each with a different primary tree host. Three species—those affecting ponderosa pine, pinyon pine, and Douglas-fir—are found throughout most of the ranges of their hosts, while the other species have more limited distributions. Regionally, over one-third of the ponderosa pine acreage has some level of infection, with roughly four million acres affected (see Table 1). Similar proportions of the mixed-conifer and woodland types appear to be affected. Dwarf mistletoe infestation is best described as a chronic situation rather than an "outbreak;" overall incidence changes little from year to year.

A Mugho pine in the Lona Sabino subdivision in the Santa Catalina Mountains of Arizona was recently found to be infected with dwarf mistletoe. It was growing under an infected ponderosa pine. Since 1992, two other non-native pines planted in Arizona—Scotch pine and Austrian pine—have been found to be susceptible to ponderosa pine dwarf mistletoe.

True Mistletoes

Phorodendron spp.

Hosts: numerous

Seven different species of true mistletoe occur on trees and shrubs in the Southwest. They are especially common on junipers throughout the woodland type in the Region, and are often found on cottonwoods, sycamores, and other hardwoods in lower riparian areas. Although generally thought to be less damaging to their hosts than dwarf mistletoes, heavy infection weakens trees and may lead to death.

Root Diseases

Root diseases are associated with roughly one-third of the conifer mortality in the Region each year.

They kill some trees outright and are often associated with bark beetle attack. They can also predispose trees to windthrow, an obvious concern in heavily-used areas. Root diseases are generally more common in mixed conifer and spruce-fir forests than in ponderosa pine forests. Like mistletoes, the incidence of most root diseases changes little from year to year.

Armillaria Root Disease

Armillaria spp.

Hosts: most conifers, aspen

Armillaria is the most common root disease in the Southwest, and may account for up to 80 percent of the root disease mortality in the Region. Recent surveys on the North Kaibab Ranger District found the fungus in about 30 percent of the standing live trees. In addition to causing disease, the fungus is a common decayer of dead woody material (a saprophyte). There appear to be several different "strains" of *Armillaria*, and some may be more virulent than others.

Annosus Root Disease

Heterobasidion annosum

Hosts: most conifers

Annosus root disease is probably the second most common root disease in the Southwest. It is found most often on true firs, although most conifers are susceptible. Like *Armillaria*, *Heterobasidion* is a common decayer of dead woody material as well as a pathogen.

Other common root diseases in the Southwest include **Schweinitzii root/butt rot**, *Phaeolus schweinitzii*, often found on older Douglas-fir and occasionally ponderosa pine; **Tomentosus root/butt rot**, *Inonotus tomentosus*, on spruce; and **Ganoderma butt rot**, *Ganoderma applanatum*, found in many aspen stands. **Black Stain root disease**, caused by varieties of the fungus *Leptographium wageneri*, appears to be rare in the Southwest.

Stem Decays

Stem decays are common in older trees throughout the Southwest. The most common include **red rot**, *Dichomitus squalens*, of ponderosa pine; **red ring rot**, *Phellinus pini*, affecting most conifers; **rust-red stringy rot**, *Echinodontium tinctium*, on white fir; and **aspen trunk rot**, *Phellinus tremulae*.

Aspen Stem Cankers

Several different canker diseases affect aspen in the Southwest. One or more of these fungal diseases are common in most aspen stands. They damage the living bark and cambium and are one reason that aspens are a relatively short-lived tree.

Stem Rusts

White Pine Blister Rust

Cronartium ribicola

Host: Southwestern white pine

This non-native disease occurs throughout most of the range of its host in the Sacramento and adjoining White Mountains of southern New Mexico. It has also been found in the nearby Capitan Mountains, which are separated from the main outbreak area by about 20 miles of high desert. Altogether, roughly one-half million acres are affected. The Sacramento/ White Mountain area contains what is probably the largest existing population of southwestern white pine and, over time, the disease will have a major impact in much of this area. Blister rust has still not been found elsewhere in the Southwest. See "Activities" section for additional information.

Broom Rusts

Melampsorella caryophyllacearum

Host: true firs

Chrysomyxa arctostaphyli

Host: spruces

Broom rusts are found at low levels throughout much of the ranges of their hosts in the Southwest. High concentrations of fir broom rust occur in the Sandia Mountains of New Mexico and at a few other locations. The disease is often quite noticeable, although damage is usually minimal. Occasionally, falling brooms and stem breakage present a hazard to humans.

Limb Rust

Cronartium arizonicum

(a variety of *Peridermium filamentosum*)

Host: Ponderosa pine

This disease is fairly common in portions of northern Arizona, and can be quite damaging to individual trees. The fungus causes progressive branch mortality, usually from the center of the crown. Waves of new infection typically occur at intervals of several years.

Comandra Blister Rust

Cronartium comandrae

Host: Pines

This disease has been damaging to plantings of the non-native Eldarica/Afghan pine in the Prescott, Payson, and Sedona areas. It occasionally infects ponderosa pines in this area, but has caused minimal damage.

Foliage Diseases

Ponderosa Pine Needle Cast

Lophodermella cerina

Discoloration attributed to this disease was detected by aerial survey on a total of 2,575 acres in 1997 compared to 2,200 acres in 1996. In Arizona, it was found on the Coconino National Forest (10 acres) and on BLM lands in the Arizona Strip (90 acres). In New Mexico, it was observed on the Gila (2,200 acres) and Santa Fe (275 acres) National Forests.

An **unidentified needle cast** disease affecting ponderosa pine was found on private lands (Baca Location) in the Jemez Mountains of northern New Mexico. About 5,180 acres of host type in and along the valleys of the Valle Grande were affected. Unlike *Lophodermella*, this fungus produced prominent fruiting structures on infected needles.

Pinyon Pine Needle Cast

Species unknown

A needle cast affecting pinyons continues to be observed on private lands in New Mexico in and around Capitan and Ruidoso and on the eastern slopes of the Sangre de Cristo Mountains. Over 500 acres of heavy pinyon needle cast were recorded in Mora County in 1997.

Needle Blight of Pinyon

A needle blight affecting pinyon pine was found on private land in northern New Mexico in 1997. A fungus, *Pestalotia* sp., was isolated from syptomatic needles collected in San Miguel County, and is presumably the cause of the disease. This fungus is

known to affect eastern white pine; to our knowledge, it has not been previously reported as a pathogen in the Southwest.

Phoma Blight of White fir

This needle disease has recently been reported to cause branch dieback and mortality in landscape white firs in Santa Fe, New Mexico.

Aspen Leaf Diseases

Both **black leaf spot**, *Marssonina populi*, and **leaf rust**, *Melampsora* spp. are common and widespread on aspens in the Southwest. The latter also commonly affected cottonwoods in many locations.

They usually occur at low levels, but in some years the fungi build to epidemic proportions and can contribute to premature defoliation. Hundreds of acres of aspen defoliation attributed to black leaf spot was noted near the Santa Fe Ski Basin in 1997.

Abiotic Damage

Drought damage was detected on a total of 957 acres of Federal lands in Arizona in 1997, compared to over 61,000 acres in 1996. It was found on the Coconino (520 acres) and Coronado (437 acres) National Forests. On State lands in Arizona, drought appeared to be responsible for some pinyon and ponderosa pine mortality in the Hualapai mountains southeast of Kingman.

A blowdown involving several hundred ponderosa pines occurred southwest of Flagstaff near Fry Park in early 1997. Ips beetles caused additional mortality in the area later in the year.

Hail reportedly damaged a large area (acres unknown) of pinyon and ponderosa pine on private land in Colfax County, New Mexico in 1997.

Biological Evaluations and Technical Assistance

Our staff is "on call" to provide information on forest insect and disease activity, including input for resource planning and management activities. We provide these services for the Forest Service and other land management agencies. The following letters/reports document much of this work done in 1997.

Arizona Zone

1. Post treatment evaluation of the 1992 Moritz and Kaufman dwarf mistletoe suppression projects. 1/97.
2. Scheduling of harvest activities to reduce *Ips* infestation in the Little Analysis Area. 1/97.
3. Prevention of *Ips*-caused pine mortality in association with the Badger Knoll thinning project, Springerville Ranger District, Apache-Sitgreaves National Forests. 2/97.
4. Monitoring of the Side and Dauber fires for bark beetle activity, Peaks Ranger District, Coconino National Forest. 5/97.
5. Threatened, endangered, and sensitive insect species on the Coconino National Forest. 5/97.
6. Bark beetle risk associated with the Hochderffer Fire, Whitehorse Salvage Area, Peaks Ranger District, Coconino National Forest. 5/97.
7. Pile burning to prevent *Ips* infestation of early slash at an administrative site on the Alpine Ranger District, Apache-Sitgreaves National Forests. 5/97.
8. Pinyon mortality south of Twin Arrows, Morman Lake Ranger District, Coconino National Forest. 5/97.
9. Silvicultural treatments and Prescott Scale. 6/97.
10. Insects and diseases in the East Rim Overlook Assessment Area. 6/97.
11. Functional assistance concerning pinyon Ips for the Wilkins Rehabilitation Project, Blue Ridge Ranger District, Coconino National Forest. 7/97.
12. Evaluation of the pinyon sawfly population near Canyon de Chelly, Navajo Indian Reservation. 8/97.
13. Functional assistance concerning the Old Moritz sale area. 8/97.
14. Alder flea beetle and sycamore anthracnose on the Beaver Creek and Sedona Ranger Districts, Coconino National Forest. 8/97.
15. Evaluation of proposed dwarf mistletoe suppression project in the Dry Lake area. 9/97.
16. Functional assistance on a hazard tree incident at Christopher Creek Campground. 9/97.
17. Pest risk assessment from import of Eucalyptus wood from South America. 11/97.
18. Possible bark beetle infestation in the Pot Fire area, Long Valley Ranger District, Coconino National Forest. 11/97.

New Mexico Zone

1. White pine blister rust survey (reliability check), Lincoln National Forest. 2/97.
2. Dwarf mistletoe control/thinning project, Picuris Pueblo. 4/97.
3. Hazard tree evaluation, Sandia Ranger District, Cibola National Forest. 5/97.
4. Hazard tree evaluation, Mount Taylor Ranger District, Cibola National Forest. 5/97.
5. Evaluation of pinyon needle scale on the Tres Piedras Ranger District, Carson National Forest. 6/97.
6. Evaluation of proposed La Juita dwarf mistletoe control project and other site visits on the Jicarilla Apache Indian Reservation. 7/97.
7. Site visits on the Sacramento Ranger District, Lincoln National Forest (spruce aphid, recent thinning projects, proposed thinning project, blister rust resistance monitoring). 7/97.
8. Linden looper defoliation near Fourth of July Campground, Mountainair Ranger District, Cibola National Forest. 7/97.
9. Proposed dwarf mistletoe control/thinning project in old Broke-off sale area, Tres Piedras Ranger District, Carson National Forest. 7/97.

10. Potential for introduction and establishment of exotic wood borers in Carlsbad, New Mexico. 7/97.
11. Dwarf mistletoe management on the Camino Real Ranger District, Carson National Forest. 8/97.
12. Proposed dwarf mistletoe control project on Jarita Mesa, El Rito Ranger District, Carson National Forest. 9/97.
13. Hazard tree evaluation, Cuba Ranger District, Cibola National Forest. 10/97.
14. Turkey Springs timber sale and proposed dwarf mistletoe control activities, Mescalero-Apache Indian Reservation. 11/97.
15. Fall webworm outbreak at Nambe Falls Recreation Area, Nambe Pueblo. 11/97.
16. Dwarf mistletoe permanent plots on Carson and Cibola National Forests, 5-year remeasurements. 11/97.
17. Turpentine beetle activity in Rendija Canyon, Espanola Ranger District, Santa Fe National Forest. 11/97.

Other Entomology and Pathology Activities in 1997

Training

The Forest Health Zone Offices offer annual training on forest insect and disease identification, biology, and management. These sessions are open to personnel from the USDA Forest Service, USDI Bureau of Indian Affairs and National Park Service, as well as other interested Federal and State agencies and Tribal resource managers. In the spring, we offer a workshop for recreation managers and their staffs which emphasizes hazard tree management. In the fall, we offer a very popular workshop for resource managers and specialists covering the entire forest ecosystem. We also offer informal training on request, particularly for field crews.

Mountain Pine Beetle Susceptibility/Risk Rating in Southwestern Ponderosa Pine

This is a multi-region project funded jointly through the Forest Health Technology Development Program and Rocky Mountain Research Station. Jesse Logan, Rocky Mountain Research Station, is the principal investigator on this project. The objective of the project is to determine significant factors affecting stand and landscape level susceptibility and risk to the mountain pine beetle, *Dendroctonus ponderosae*, in southwestern ponderosa pine. Many factors are being examined including stand conditions, weather, and beetle population status. This information will be incorporated into a decision support system that will provide land managers with a landscape description of susceptibility and risk. Contact Jill Wilson at the Arizona Zone Office for more information.

Site and Stand Factors Associated with the Occurrence of Roundheaded Pine Beetle Outbreaks in Ponderosa Pine

The roundheaded pine beetle, *Dendroctonus adjunctus* is one of the most important bark beetles associated with ponderosa pine in southern New Mexico and Arizona. In 1994, a cooperative project involving the Rocky Mountain Research Station, Southwestern Region, and Lincoln and Coronado National Forests was begun to quantify and model site and stand conditions conducive to infestations. Jose Negron, Rocky Mountain Research Station, is the principal investigator on this project. Results from the Lincoln National Forest suggest increased likelihood of infestation under slow growth conditions and increased mortality with increased levels of initial ponderosa pine basal area. Contact Jill Wilson at the Arizona Zone Office for more information.

Pinyon Ips Tree and Stand Conditions Project

Pinyon ips, *Ips confusus*, is the most important bark beetle affecting pinyon pine in the Southwest. Several large outbreaks have been recorded. In 1997 an outbreak covering over 12,000 acres was discovered on the Coconino National Forest southeast of Flagstaff. Since little is known about the conditions that favor outbreaks of this insect, a cooperative project involving Rocky Mountain Research Station (Jose Negron) and the Arizona Zone Office (Jill Wilson) was initiated to look at this more closely. Project objectives are two fold, first to look at which individual tree variables may influence likelihood of attack and second to examine the effect of certain stand variables on the level of infestation. Examining both of these questions will help to better understand how pinyon ips interacts with its host.

Evaluation of Pinyon Sawfly Populations in Northeast Arizona

Pinyon sawfly, *Zadiprion rohweri*, caused significant defoliation of pinyon pine in Canyon de Chelly National Monument and surrounding areas of the Navajo Indian Reservation in 1996. Evaluation of the sawfly population and its impact is a cooperative effort between the Arizona Zone Office, Dr. Ann Lynch of the Rocky Mountain Research Station, and Dr. Michael Wagner of Northern Arizona University. During the 1997 field season, pinyon needle scale, *Matsucoccus acalyptus*, was found to be feeding along with pinyon sawfly on the same or adjacent hosts, complicating impact assessment. Evaluation will continue in 1998. Data gathered will be used to try to predict future outbreaks and their impacts based on environmental conditions and population trends. Contact Bobbe Fitzgibbon at the Arizona Zone Office for more information.

White Pine Blister Rust Studies

Hazard Rating System: A 2-year project to develop a rust hazard rating system for the Sacramento Mountains got underway in 1997. The rating system will be based on easily determined site factors, such as elevation, slope position, and plant association (habitat type), that can be used to predict disease severity. An initial model based on these three

factors has already been developed. The highest rust hazard appears to be above 8000 feet along lower slopes in the white fir series.

White pines are being sampled in several stands covering a wide range of conditions to test and improve the initial model. Information is also being gathered on *Ribes*, the alternate host for the blister rust fungus. Meteorological data may be collected on several sites to correlate with rust severity.

The hazard rating system will help us better understand how various site factors can be used to make predictions about rust severity and impact, and should provide information useful for management of particular sites. It should also help us predict where the disease could eventually become a problem in other parts of the Region. The project is funded through the Forest Health Technology Development Program.

Resistance Testing: In 1995, we tagged 75 rust-free southwestern white pines of seed-bearing age located in a heavily infected area. In 1997, there was a good cone crop and we were able to collect cones from 14 of these trees (plus some from a few infected trees, for comparison). The cones were sent to the Institute of Forest Genetics in Placerville, California for testing. There, young seedlings will be grown in a greenhouse and dusted with rust spores. Based on a reaction in the needles, it will be possible to quickly determine if there is genetic resistance.

An understanding of the level of resistance in Southwestern white pine will help us better predict the long-term impacts of the disease. Also, if inherited resistance is found, it may eventually be feasible to use cultural practices to encourage natural regeneration of resistant parent trees and/or to collect seed to produce resistant planting stock.

Monitoring Plots: Between 1991 and 1997, we established 12 monitoring plots to document current rust levels and to follow long-term increases in, and effects of, the disease. The plots are located in easily accessible areas throughout the Sacramento and adjoining White Mountain ranges, and include a wide range of site conditions and disease levels. The sample on each plot consists of 40-50 white pines of various sizes, from small saplings to mature trees. Observations are being made on each plot every three years on a rotating basis so every year, 3 to 5 plots will be remeasured.

Based on the latest observations, 168 (30%) of the 554 sample trees are infected. Twelve percent of the sample trees have rust cankers on the main stem, and are expected to eventually be killed by the disease. So far, about one percent of the sample trees have been killed by rust since the plots were installed.

Although these plots do not provide a statistical sample of the white pine population in the outbreak area, they are thought to be fairly representative of conditions, and should provide a general idea of the development of the outbreak over time. Information from the plots was used to help develop our initial rust hazard model.

For additional information on these studies contact Dave Conklin, New Mexico Zone Office, or Brian Geils, Rocky Mountain Research Station.

Wood Import Pest Risk Assessment and Mitigation Evaluation Team

The nationally-chartered Wood Import Pest Risk Assessment and Mitigation Evaluation Team, led by Borys Tkacz, Arizona Zone Leader, completed a pest risk assessment for the importation of *Pinus* and *Abies* logs from Mexico. The team evaluated Mexican insects and pathogens that are not currently found in the United States and those that may be genetically different from U.S. species. The assessment identified eight insects and pathogens of Mexican pines that present a high risk to forests of the U.S. These are: *Dendroctonus mexicanus, Coptotermes crassus, Pterophylla beltrani, Ips bonanseai, Gnathotrichus perniciosus, Gnathotrichus nitidifrons, Fusarium subglutinans* f. sp. *pini*, and *Ophiostoma* spp. A moderate risk potential was assigned to nine other pests of Mexican pines: *Pineus* spp. *Lophocampa alternata, Hylesia frigida, Hypoderma* spp., *Lophodermella* spp., *Synanthedon cardinalis, Heterobasidion annosum, Sphaeropsis sapinea, Bursaphelenchus xylophilus, Cronartium* spp., and *Peridermium* spp. The pests of concern with a moderate or high pest risk potential for Mexican *Abies* logs include *Lophocampa alternata, Scolytus mundus, S. aztecus, Pseudohylesinus variegatus, P. magnus, Ophiostoma abietinum,* and *Heterobasidion annosum*. For these organisms, specific phytosanitary measures may be required to ensure the quarantine safety of proposed importations.

WEB Site

The Arizona Zone and New Mexico Zone offices continue to maintain an active web site on the internet. This site provides a public forum for reporting past and present insect and disease conditions, biology, training opportunities, and mission statement. Hosted by the Northern Arizona University School of Ecosystem Science and Management, it can be accessed at **http://www.for.nau.edu/usfs/r3_fpm.** It is linked to the USDA Forest Service, Region 3 homepage and the Washington Office Forest Health homepage. Steve Dudley of the Arizona Zone is the webmaster.